Metamaterial-Backed Conformal Antennas for Space Exploration

Completed Technology Project (2013 - 2014)

Project Introduction

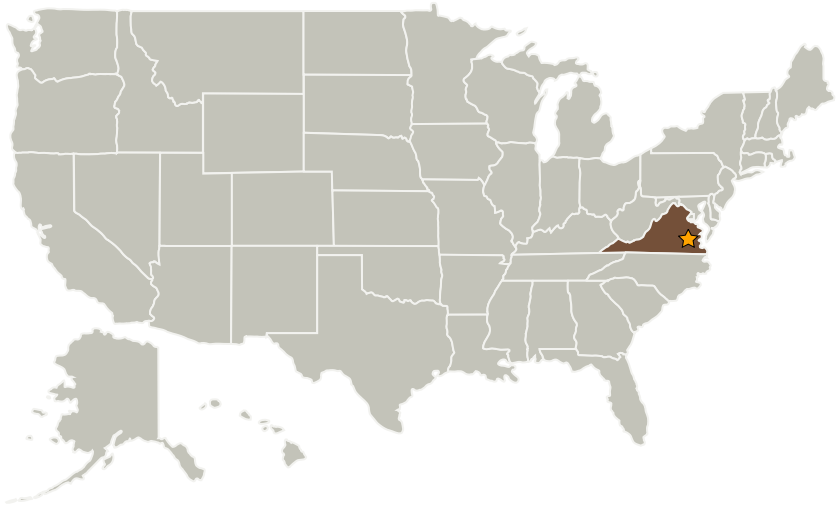
The purpose of this experiment is to demonstrate a successful X-band antenna array fabricated on a high-permittivity substrate together with bandgap metamaterials that enhance the antenna performance by reducing surface waves. The current goal is to demonstrate X-band patch antenna and bandgap metamaterials separately, then demonstrate antenna patches and metamaterial integrated into a working array.

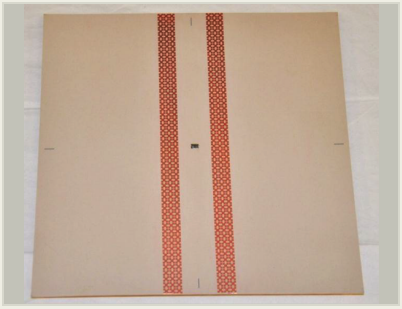
The high-permittivity substrate (er = 10.2) allows individual antenna patches to be made smaller and also mimics substrates (Si, SiC, GaAs, InP, GaN) used in MMIC and OEIC technology. If successful, the antennas may be integrated together with receiver components on the same substrate for miniaturization. Another important benefit is that surface waves are inhibited so that devices on the same substrate are isolated from each other.

Anticipated Benefits

The antenna design will decrease the size and weight of the patch antenna and associated hardware; thus surface area and operating power can be saved on a space flight vehicle. However, this technology is not limited to space flight and could be utilized on almost any vehicle.

Primary U.S. Work Locations and Key Partners





Project Image Metamaterial-Backed Conformal Antennas for Space Exploration

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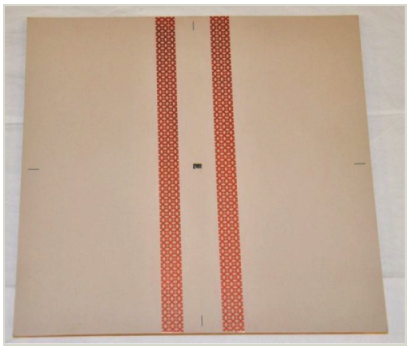
Organizations Performing Work	Role	Type	Location
★Langley Research Center(LaRC)	Lead Organization	NASA Center	Hampton, Virginia

Co-Funding Partners	Type	Location
Old Dominion University Research Foundation(ODURF)	Academia	Norfolk, Virginia

Primary U.S. Work Locations
Virginia

Images



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Project Image Metamaterial-Backed Conformal Antennas for Space Exploration
(https://techport.nasa.gov/image/2272)

Organizational Responsibility

Responsible Mission Directorate:
Mission Support Directorate (MSD)

Lead Center / Facility:
Langley Research Center (LaRC)

Responsible Program:
Center Independent Research & Development: LaRC IRAD

Project Management

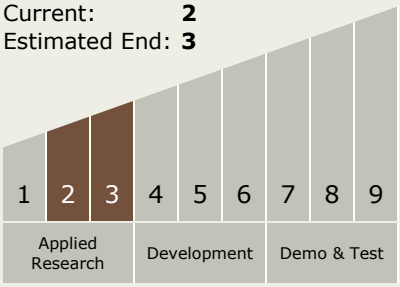
Program Manager:
Julie A Williams-byrd

Project Manager:
Anne Mackenzie

Principal Investigator:
Anne Mackenzie

Technology Maturity (TRL)

Start: **2**
Current: **2**
Estimated End: **3**



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Technology Areas

Primary:

- TX05 Communications, Navigation, and Orbital Debris Tracking and Characterization Systems
  - TX05.2 Radio Frequency
    - TX05.2.6 Innovative Antennas